BOMBARDIER Toronto (de Havilland) **PROPRIETARY INFORMATION**	**PPS 6.21** **PRODUCTION PROCESS STANDARD**

Assembly and Installation of Quickfit Fittings

Issue 11
- This standard supersedes PPS 6.21, Issue 10.
- Vertical lines in the left hand margin indicate technical changes over the previous issue.
- This PPS is effective as of the distribution date.
- Validation of issue status is the responsibility of the user.

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	Core Methods - PPS		

Issue 11 - Summary of Changes (over the previous issue)

The following summaries are not detailed and are intended only to assist in alerting PPS users to changes which may affect them; refer to the applicable sections of this PPS for detailed procedure and requirements.

- Added new Dykem Cross Check tamper proof mark for torque marking.
- Deleted Bombardier Toronto (de Havilland) specific instruction to only use 3M EC-1252 tamper proof sealant to depletion of existing stock.
- Revised references to tamper proof sealant resistance to hydraulic fluids (e.g., Skydrol) to specify that all the tamper proof sealants specified are resistant to splashes of hydraulic fluid but are not resistant to immersion.
- Added an instruction to allow applied tamper proof sealant to cure undisturbed according to the manufacturers' instructions.
- Added an instruction to apply tamper proof sealant sparingly, especially in overhead applications.
- Revised/clarified safety precautions relating to tamper proof sealant.
- Revised caution regarding exposure of hydraulic fluid lines and components to be used with MIL-H-5606 hydraulic fluid blends containing isopropyl alcohol to delete reference to documents superseding MIL-H-5606.

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Tables

Figures

1 Scope

1.1 This Production Process Standard (PPS) specifies the procedure and requirements for the assembly and installation of Quickfit permanent joint system fittings.

1.1.1 This PPS complements the engineering drawings that specify its use as an authorized instruction. The procedure specified in this PPS must be followed to ensure compliance with all applicable specifications. In general, if this PPS conflicts with the engineering drawing, follow the engineering drawing. The requirements specified in this PPS are necessary to fulfil the engineering design and reliability objectives.

1.1.2 Refer to PPS 13.26 for the subcontractor provisions applicable to this PPS.

1.1.3 Procedure or requirements specified in a Bombardier BAPS, MPS, LES or P. Spec. **do not** supersede the procedure or requirements specified in this PPS.

2 Hazardous Materials

2.1 Before receipt at Bombardier Toronto (de Havilland), all materials must be approved and assigned Material Safety Data Sheet (MSDS) numbers by the Bombardier Toronto (de Havilland) Environment, Health and Safety Department. Refer to the manufacturer's MSDS for specific safety data on any of the materials specified in this PPS. If the MSDS is not available, contact the Bombardier Toronto (de Havilland) Environment, Health and Safety Department.

3 References

3.1 General

3.1.1 Unless a specific issue is indicated, the issue of the reference documents specified in this section in effect at the time of manufacture shall form a part of this specification to the extent indicated herein.

3.2 Bombardier Toronto (de Havilland) Process Specifications

3.2.1 PPS 6.03 - Installation of Fluid Lines and Fittings.

3.2.2 PPS 6.10 - Cleaning of Fluid System Components.

3.2.3 PPS 6.12 - Pressure Testing Hydraulic Components and High Pressure Fuel Lines.

3.2.4 PPS 13.26 - General Subcontractor Provisions.

3.2.5 PPS 13.28 - Storage Life of Adhesives, Sealants, Paints and Composite Products.

3.2.6 PPS 13.39 - Bombardier Toronto Engineering Process Manual.

3.2.7 PPS 14.01 - Torquing Method and Identification.

3.2.8 PPS 27.05 - Manual Edge Finishing.

3.2.9 PPS 31.07 - Cleaning and Stripping of Painted Surfaces.

3.2.10 PPS 31.17 - Solvent Usage.

4 Materials, Equipment and Facilities

4.1 Materials

4.1.1 Unless otherwise specified in this section, use only the materials specified; use of superseding or alternative materials is not allowed.

4.1.2 Quickfit fittings as specified by the engineering drawing. Refer to Figure 1 for a part number breakdown.

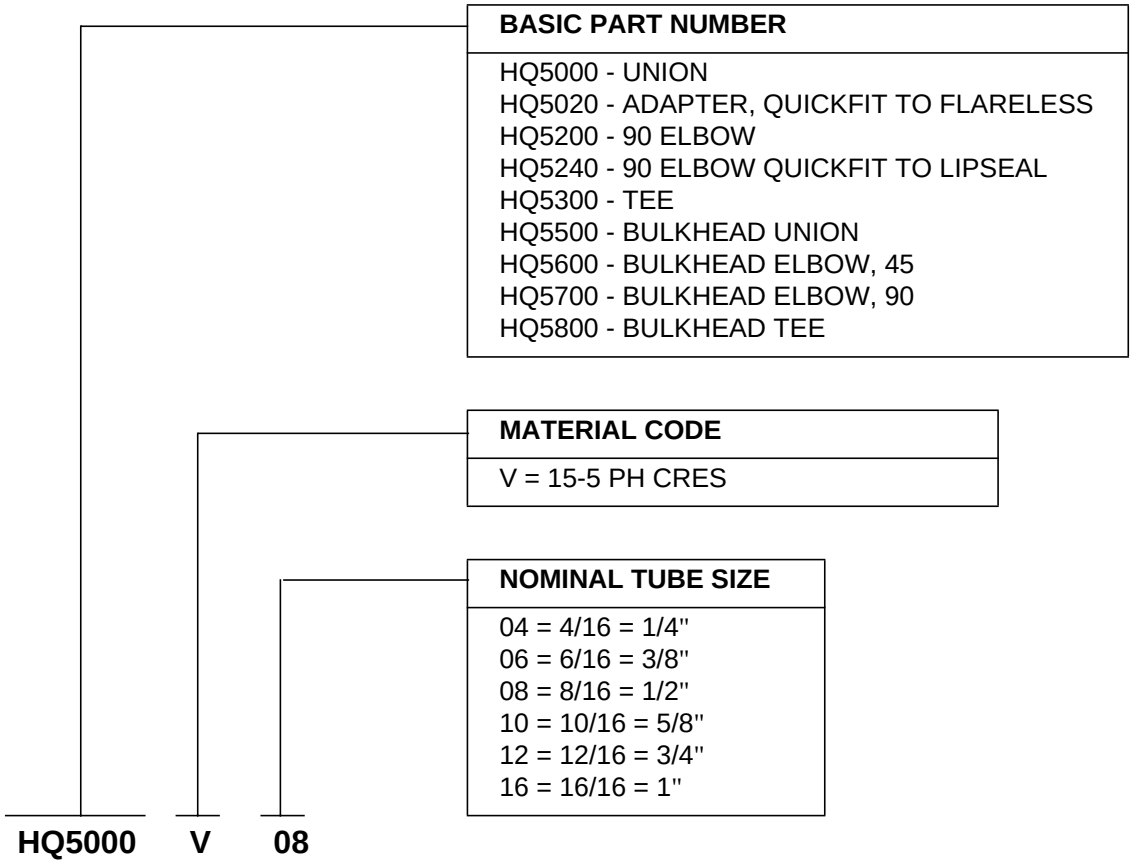

Figure 1 - Quickfit Part Number Breakdown

4.1.3 Polishing material, Scotch-Brite pads, Type A Fine (maroon colour).

4.1.4 Extreme pressure lubricant (e.g., MIL-G-23827, MIL-PRF-23827, etc.).

4.1.5 Tamper proof sealant, white:

- Dykem Cross Check tamper proof torque mark, p/n 83319 (white)
- Organic Products Co. F-900 or F-925 Torque Seal
- 3M EC-1252 tamper proof sealant

4.1.5.1 Refer to PPS 13.28 for the storage life of tamper proof sealant. The tamper proof sealants specified herein are resistant to splashes of hydraulic fluid (e.g., Skydrol) but are not resistant to immersion. After application, allow tamper proof sealant to cure undisturbed according to the manufacturer's recommendations. Apply tamper proof sealant sparingly, do not apply more than needed, especially in overhead applications.

4.2 Equipment

4.2.1 Quickfit hydraulic tools, installation tools and tube marking gauges as specified in Table 1.

4.2.2 Chipless tube cutter (e.g., TS.621.32.11).

4.2.3 Felt-tip paint marker (e.g., J.P. Nissen Jr. Co.).

4.2.4 Manual or electric hydraulic pump, maximum pressure 10,000 psig.

Table 1 - Installation Tooling Part Numbers

Tube Size	Marking Gauge	Quickfit Mini-Tool	Wrench Size		Quickfit Hydraulic Tool
			Tool Body	Tool Slide	
4 (1/4")	HT5104	HT5004	13/16"	3/4"	HT5504 or HT5604
6 (3/8")	HT5106	HT5006	1"	7/8"	HT5506, HT5606 or SK1076
8 (1/2")	HT5108	HT5008	1 1/8"	1"	HT5508 or HT5608
10 (5/8")	HT5110	HT5010	1 3/8"	1 1/4"	HT5510 or HT5610
12 (3/4")	HT5112	HT5012	1 1/2"	1 1/4"	HT5512 or HT5612
16 (1")	HT5116	HT5016	1 11/16"	1 1/2"	HT5516 or HT5616

4.3 Facilities

4.3.1 This PPS has been categorized as a “Controlled Special Process” according to PPS 13.39 and as such only facilities specifically approved according to PPS 13.39 are authorized to perform installation of Quickfit fittings according to this PPS.

4.3.2 Bombardier subcontractors must direct requests for approval to Bombardier Aerospace Supplier Quality Management. Bombardier Aerospace facilities must direct requests for approval to the appropriate internal Quality Manager.

4.3.3 Facility approval shall be based on a facility report, a facility survey and completion of a qualification test program, if required. The facility report must detail the materials and equipment to be used, the process sequence to be followed and the laboratory facilities used to show compliance with the requirements of this PPS. Any deviation from the procedure or requirements of this PPS must be detailed in the facility report. Based upon the facility report, Bombardier Toronto (de Havilland) Materials Technology may identify additional qualification and/or process control test requirements. During the facility survey, the facility requesting qualification must be prepared to demonstrate their capability. Once approved, no changes to subcontractor facilities may be made without prior written approval from Bombardier Aerospace Supplier Quality Management.

4.3.3.1 Unless otherwise specified by Bombardier Aerospace Supplier Quality Management, for approval of subcontractor facilities to perform installation of Quickfit fittings according to this PPS, completion of a test program and submission of suitable test samples representative of production parts is required. Test samples must meet the requirements specified in section 6.

5 Procedure

5.1 General

5.1.1 Quickfit fittings are swaged axially which deforms the tube from the outside diameter. It is an entirely metal-to-metal seal and a permanent installation.

5.1.2 Install Quickfit fittings only if specified on the engineering drawing. Quickfit fittings are typically used to join line assemblies located within the pressurized area of the aircraft.

5.1.3 Before swaging the fitting, ensure that the aluminum tubing is in the final heat treat temper specified on the engineering drawing.

5.1.4 Install fluid lines and fittings according to PPS 6.03.

5.2 Cutting of Tubing

5.2.1 Cut tubing to length using a chipless tube cutter as follows.

Step 1. Loosen the drive screw using a hex wrench and locate the cutter head on the tube in the desired cutting position (see Figure 2). A 1.25" minimum length straight section of tubing must be left at the cut end to allow the Quickfit fitting to seat correctly.

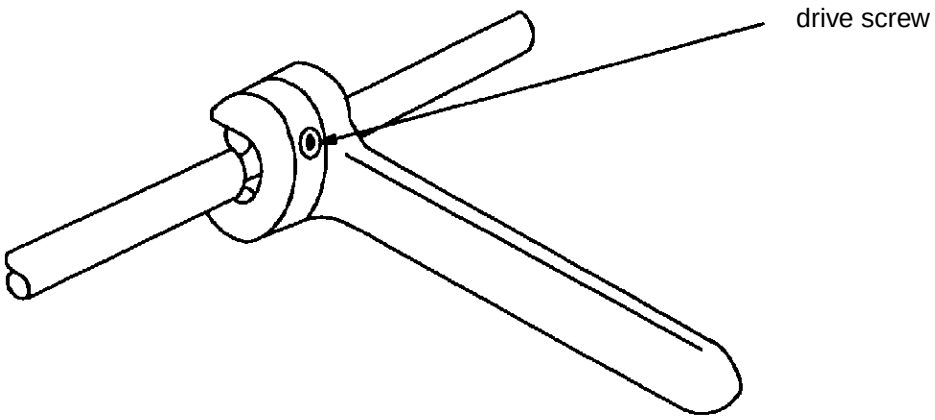

Figure 2 - Chipless Cutter

Step 2. Tighten the drive screw until the cutter wheel contacts the tube, then tighten 1/4 of a turn.

Step 3. Rotate the tool handle back and forth around the tube until there is no longer any resistance.

Step 4. Tighten the drive screw a further 1/8 to 1/4 turn.

Step 5. Repeat step 3 and step 4 until the cut is complete.

Step 6. Ensure cut tube ends are square to within ±1°.

5.3 Preparation

5.3.1 Prepare tubing as follows:

Step 1. Ensure that the tube surface is free of dirt, grease, etc. for at least 4" from the tube end.

Step 2. Chamfer and deburr the tube end receiving the Quickfit fitting according to PPS 27.05.

Step 3. Solvent clean the tube end according to PPS 31.17.

Step 4. Slide the appropriate marking gauge (see Table 1) over the tube end until the gauge butts against the end of the tube. Mark the tube with a felt-tip marker in the tube insertion mark holes. If swaging a union, repeat with the second tube end.

Table 2 - Maximum Allowable Gap Between Tube Ends

Tube Size	Maximum Gap	Tube Size	Maximum Gap
4 (1/4")	0.200"	10 (5/8")	0.300"
6 (3/8")	0.270"	12 (3/4")	0.400"
8 (1/2")	0.300"	16 (1")	0.400"

Step 5. For unions, wrap masking tape once around one of the tube ends halfway over the smaller tube insertion mark (see Figure 3). Tubes receiving shaped or adapter fittings do not require taping since the fittings have an inner diameter tube stop shoulder.

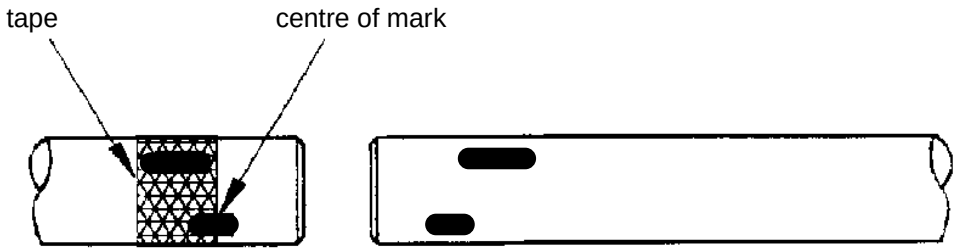

Figure 3 - Tube Marking and Set-Up

Step 6. If swaging unions, slide the union over the untaped tube. Ensure the gap between the two tube ends meets the requirements of Table 2. Then, slide the union across the gap until the union butts against the tape. For all other fittings, slide the fitting onto the tube until the fitting butts against the tube end.

5.3.2 If using an electric hydraulic pump with the Quickfit hydraulic swage tool, prepare the pump as follows:

Step 1. Loosen the jam nut while holding the hex socket with an Allen wrench.

Step 2. Step on the foot switch and turn the Allen wrench until the required swage pressure is shown on the pressure gauge.

Step 3. Release the foot switch to stop the motor and release pressure.

Step 4. Re-tighten the jam nut.

Step 5. Check for constant pressure by stepping on the foot switch several times.

Step 6. If required, connect the hose extension to the pump.

5.4 Installation of Bulkhead Fittings

5.4.1 Install bulkhead fittings as follows:

Step 1. Assemble Quickfit bulkhead fittings in place on the aircraft.

Step 2. Align elbow bulkhead fittings by inserting the tube into the fitting and clamping the tube in its correct location before tightening the jam nut.

Step 3. Torque the bulkhead fitting jam nut according to PPS 14.01 while holding the fitting to prevent rotation. Elbow fittings can be held in place by hand. Use a wrench to hold union fittings in place.

Step 4. Apply a rotation witness mark to the fitting using white tamper-proof sealant (ref. para. 4.1.5). Do not mark the fitting jam nut.

5.5 Repair of Defects in Line Sections

5.5.1 If authorized by Liaison Engineering, repair defects in line sections as follows:

Step 1. Using a chipless tube cutter, cut a section from the line to remove the defect.

Step 2. If the resulting gap between tube ends will be greater than the value given in Table 2, cut out a section of the damaged tube long enough to accommodate the installation of two unions and deburr a splice tube to replace the cut out section.

Step 3. With Scotch-Brite pads, remove paint on any tube surfaces in the area in which the Quickfit fitting is to be installed.

Step 4. Tube surfaces must be free of scratches and gouges.

Step 5. Taking care to avoid contaminating the hydraulic line with debris, chamfer and deburr the tube ends according to PPS 27.05.

Step 6. Solvent wash the tube end according to PPS 31.17.

Step 7. Install Quickfit fittings as specified in section 5.6, section 5.7 or section 5.8 as applicable.

5.6 Swaging with the Quickfit Mini-Tool

5.6.1 If using the Quickfit Mini-Tool, use the following swaging procedure:

Step 1. Assemble the Quickfit Mini-Tool slide and body around the side of the fitting to be swaged. For unions, begin with the taped side (see Figure 4).

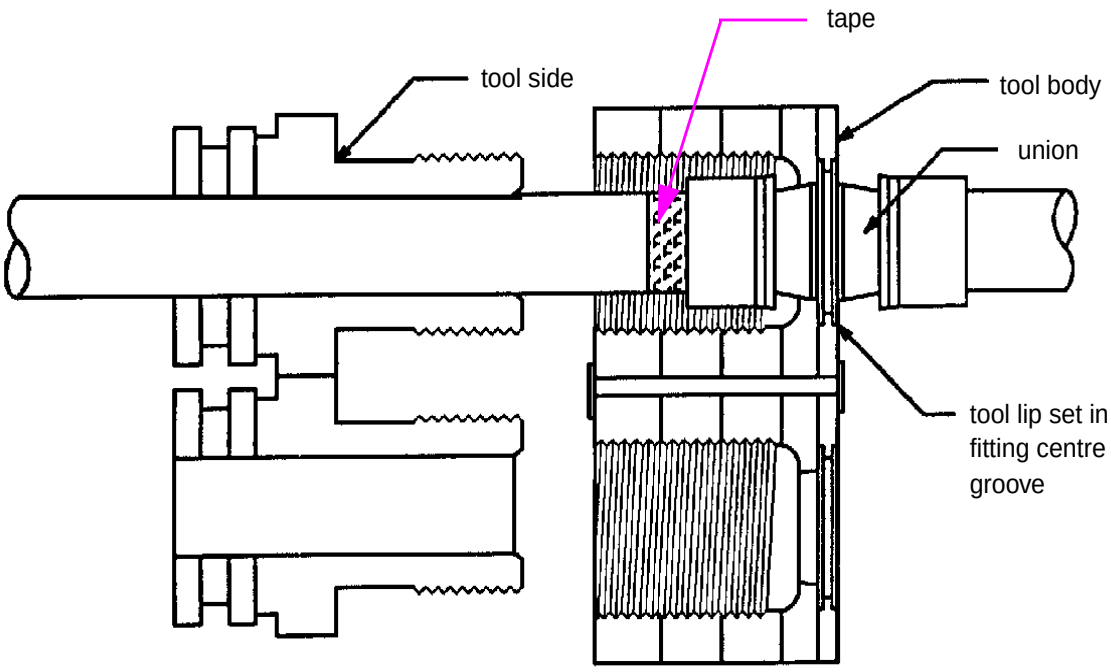

Figure 4 - Positioning the Quickfit Mini-Tool around the Fitting

Step 2. Holding the tool slide closed, slide it forward until it just engages its threads with the threads on the tool body. Apply a light coating of extreme pressure lubricant to the exposed threads.

Step 3. Holding the fitting gently against the tape, screw the slide into the body as far as possible by hand. The fitting should then stay in place on the tube.

Step 4. Using the appropriate open end wrenches from Table 1, hold the tool body stationary and screw the slide into the body until the white swage complete indicator touches the tool body (see Figure 5 and Figure 6).

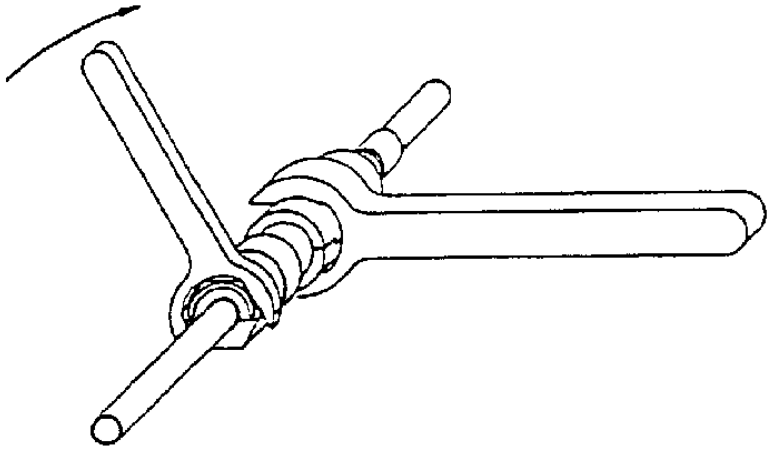

Figure 5 - Swaging Process using the Quickfit Mini-Tool

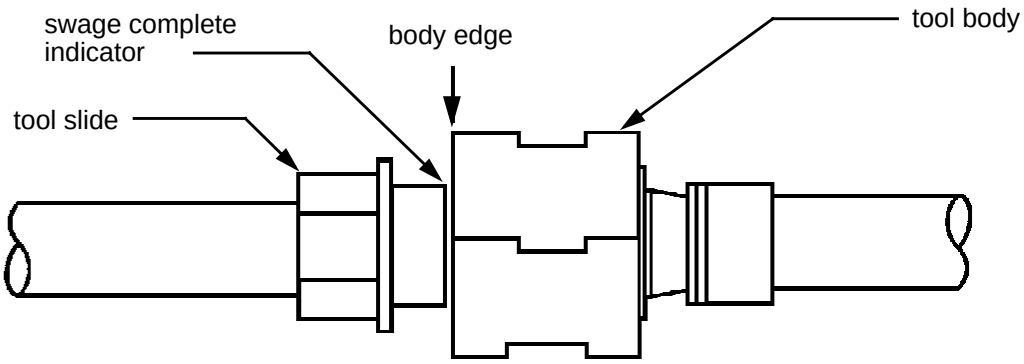

Figure 6 - Swage Complete Indicator

Step 5. Unscrew the tool slide from the body and remove the tool.

Step 6. Tear any exposed tape off the tube and check that a partial tube insertion mark is showing (see Figure 8). If the tube insertion mark is completely visible or completely covered, the swage is unacceptable and must be replaced.

Step 7. If swaging a union, repeat this procedure for the untaped side of the fitting.

Step 8. Using a feeler gauge, check that the gaps between the outside edges of the swage tool engagement groove and the inside edges of the swage rings do not exceed 0.015" (see Figure 9). If either gap is excessive, reinstall the tool on the applicable side and re-swage until the proper compression is achieved.

Step 9. Apply a rotation witness mark to the swaged fitting using white tamper-proof sealant (ref. para. 4.1.5).

5.7 Swaging using the Quickfit Hydraulic Tool

5.7.1 If using the Quickfit hydraulic tool (see Figure 7), swage the fitting as follows:

Step 1. Rotate the jaw retaining latch and pivot the fitting body jaw and ring jaw into the open position.

Step 2. Place the fitting/tube assembly in the tool so that the lip on the fitting body jaw engages the central groove in the fitting. The taped tube end should extend through the ring jaw.

Step 3. When the fitting is seated securely in the fitting body jaw, pivot both jaws to the closed position.

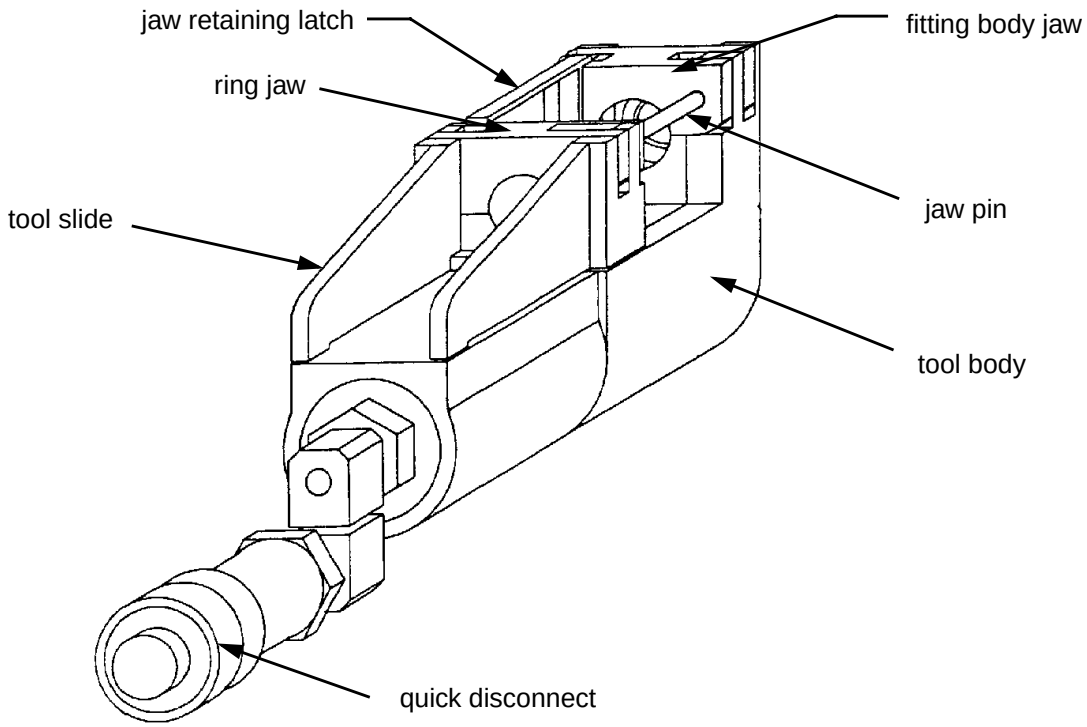

Figure 7 - Quickfit Hydraulic Tool

Step 4. Rotate the jaw retaining latch to the closed position. Do not pressurize the hydraulic tool without the jaw retaining latch in the closed position to avoid injury and tool damage.

Step 5. Attach the pump to the quick disconnect of the hydraulic tool.

Step 6. Apply pressure to the hydraulic tool to a maximum of 10,000 psig. As pressure is applied, the tool slide containing the ring jaws will move forward onto the fitting body. When the swage is complete, an audible snap can be heard as the ring retaining lip passes over the threshold of the ring retaining groove on the fitting. At this point, release the hydraulic pressure.

Step 7. Pivot the jaw retaining latch to the open position and open the fitting body jaw and the ring jaw.

Step 8. Remove the swaged tube.

Step 9. Remove any exposed masking tape from the tube and check that a partial tube insertion mark is visible (see Figure 8). If the tube insertion mark is completely visible or completely covered, the swage is unacceptable and must be replaced.

Step 10. If swaging a union, repeat step 2 through step 9 for the other tube end.

Step 11. Using a feeler gauge, check that the gaps between the outside edges of the swage tool engagement groove and the inside edges of the swage rings do not exceed 0.015" (see Figure 9). If either gap is excessive, reinstall the tool on the applicable side and re-swage until the proper compression is achieved.

Step 12. Apply a rotation witness mark to the swaged fitting using white tamper-proof sealant (ref. para. 4.1.5).

5.8 Setting the Quickfit Hydraulic Tool in the “Pull Mode”

5.8.1 If there is insufficient clearance to swage a union with the tool in the normal mode, set the tool into the “pull mode” by reversing the fitting body and ring jaws (see Figure 7) as follows:

Step 1. Release hydraulic pressure from the tool and disconnect the pump.

Step 2. Remove the jaw retaining latch from the tool body.

Step 3. Unscrew the jaw pin and remove it from the tool assembly.

Step 4. Remove the fitting body jaws from the tool body and the ring jaws from the tool slide.

Step 5. Place the fitting body jaws in the tool slide and the ring jaws in the tool body.

Step 6. Replace the jaw pin in the hole opposite the hole from which it was removed.

Step 7. Replace the jaw retaining latch in the tool slide.

5.8.2 The tool should be returned to the normal mode when the “pull mode” is no longer needed. To do this, repeat the above steps but place the fitting body jaws back in the tool body and the ring jaws in the tool slide.

6 Requirements

6.1 Remnants of masking tape left under the completed Quickfit fitting is acceptable.

6.2 Check the rotation witness marks on all bulkhead fitting jam nuts for evidence of rotation. If rotation has occurred, attempt to realign the witness mark as follows:

Step 1. While holding the fitting to prevent rotation, loosen the jam nut. If the witness mark remains displaced, loosen the coupling nut.

Step 2. If the witness mark is realigned or can be realigned with a slight rotation by hand, re-torque the jam nut and the coupling nut. If the mark cannot be realigned, the fitting is not acceptable.

6.3 Check the rotation witness marks placed on all unions for evidence of rotation. If rotation has occurred, take corrective action as required.

6.4 Check the fitting for proper location of the tube insertion marks. Marks must be partially visible as shown in Figure 8. Replace the fitting if a mark is either completely hidden or completely visible.

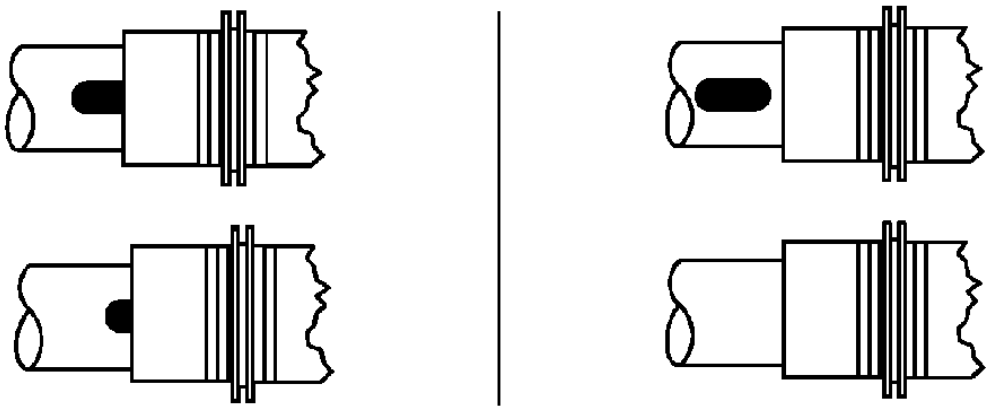

Figure 8 - Tube Insertion Marks

6.5 Check all swaged Quickfit fittings for the correct degree of swage by measuring the gap between the fitting body and the centre ring (see Figure 9). A gap of less than 0.015" is required.

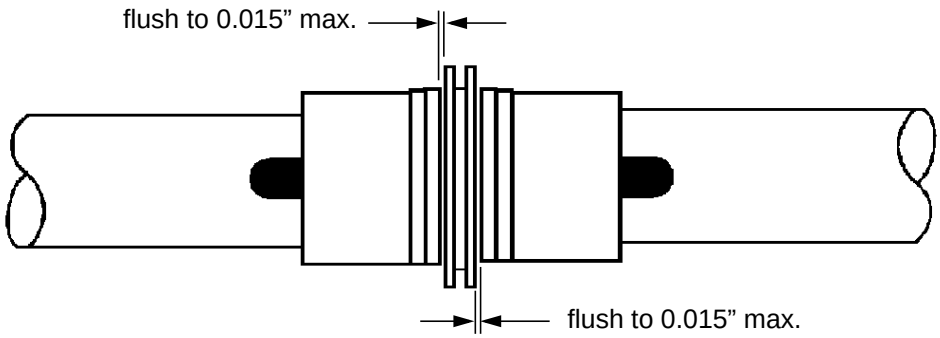

Figure 9 - Ring Position for Completed Swage

6.6 Pressure test tube assemblies having a swaged fitting that are visually and dimensionally acceptable according to PPS 6.12. For assemblies that have been installed and swaged in the aircraft, the pressure test must be performed by isolating the applicable section of line or, if this is not possible, during the aircraft functional test procedures. Any Quickfit fittings that leak during pressure testing are not acceptable.

7 Safety Precautions

7.1 The safety precautions specified herein are specific to Bombardier Toronto to meet Canadian Federal and Provincial government environmental, health and safety regulations. It is recommended that other facilities consider these safety precautions; however, suppliers, subcontractors and partners are responsible for ensuring that their own environmental, health and safety precautions satisfy the appropriate local government regulations.

7.2 Observe general shop safety precautions when performing the procedure specified herein.

7.3 Do not pressurize the Quickfit hydraulic tool without the jaw retaining latch in the closed position. Failure to do so can result in injury and/or tool damage.

7.4 Ensure sufficient ventilation when applying tamper proof sealant, especially in confined areas.

7.5 Avoid skin and eye contact with tamper proof sealant. Wear chemical resistant protective gloves when applying tamper proof sealant. If skin contact occurs, wash the affected area immediately and thoroughly with soap and water. If eye contact occurs, immediately flush eyes with large quantities of water at an eye-wash station; after initial flushing, remove any contact lenses and continue flushing for at least 15 minutes. Report any contact with tamper proof sealant to the Health Centre. Take care when applying tamper proof sealant in overhead applications to avoid applying excess sealant, as drips may result.

8 Personnel Requirements

8.1 This PPS has been categorized as a “Controlled Special Process” by PPS 13.39. Refer to PPS 13.39 for personnel requirements.

9 Additional Information

9.1 Take care to ensure that hydraulic fluid lines and hydraulic system components used with MIL-H-5606 hydraulic fluid do not come into contact with solvent blends containing isopropyl alcohol (IPA), also known as isopropanol and 2-propanol. Hydraulic fluid lines and hydraulic system components used with MIL-H-5606 hydraulic fluid which have been contaminated with solvent blends containing isopropyl alcohol must be cleaned according to PPS 6.10.